titanium nitride, titanium tungsten, nitrided titanium-tungsten, magnesium, or another suitable barrier material (col. 5) but that Zhao et al. do not show this barrier layer to be an oxide layer doped with one of magnesium, calcium, strontium, beryllium, or barium, and that the abstract in Welsch et al. shows directionally grown capacitor anodes where the dielectric layer is doped with oxides of Ca, Mg, Sr, Be, and Ba. Regarding claims 2, 3, 17, 19, and 20, the Examiner further stated that the abstract section of Welsch et al. shows a directionally grown capacitor anodes where the dielectric layer is doped with oxides. Regarding claims 8 and 13, the Examiner stated that Fig.'s 3-10 show multiple layers of copper interconnect structure with multiple layers of dielectric and barrier. Regarding claims 14, 16, and 18, the Examiner stated that columns 8-12 show the method of making a copper interconnect with multiple layers.

It would not be obvious to form the barrier layers of Zhao et al. with the dielectric layers doped with oxides of Ca, Mg, Sr, Be, or Ba of Welsch et al. to form the barrier layer comprising a silicon oxide layer doped with divalent ion dopant, as recited in claims 1, 14, and 18. The dielectric doped with oxides of Ca, Mg, Sr, Be, or Ba is not the same thing as a silicon oxide layer doped with divalent ion dopant. Neither Zhoa et al. nor Welsch et al. teaches a silicon oxide layer doped with a divalent ion dopant. Instead, Welsch teaches a dielectric doped with oxides of Ca, Mg, Sr, Be, or Ba. The purpose of Welsch et al. doping a dielectric with oxides of Ca, Mg, Sr, Be, or Ba is to improve the film's dielectric constant (see the abstract of Welsch et al.). Page 1, lines 26-28, of the present application states that it is desirable to avoid increasing the dielectric constant of the oxide, by keeping the barrier layers thin. The properties of a dielectric doped with oxides of Ca, Mg, Sr, Be, or Ba are different than the properties of a silicon oxide doped with a divalent ion dopant.

Even if the properties of a dielectric doped with oxides of Ca, Mg, Sr, Be, or Ba as taught by Welsch et al. were the same as a silicon oxide doped with a divalent ion, as recited in claims 1, 14, and 18, it would not be obvious that the dielectric doped with oxides of Ca, Mg, Sr, Be, or Ba would be a successful copper barrier layer. The Examiner has failed to show that the combined references would have a likelihood of success of providing a copper barrier layer using the doped dielectric of Welsch et al. The Examiner pointed to nothing in Zhao et al. or Welsch et al. that teaches that a dielectric doped with oxides of Ca, Mg, Sr, Be, or Ba would successfully form a copper barrier layer, which would keep copper from migrating through the layer past the barrier layer.

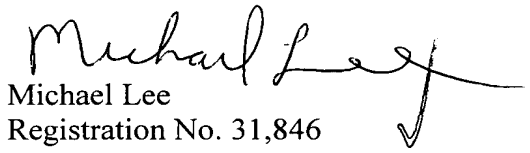
The Examiner stated that it would have been obvious to have a barrier dielectric layer of oxide doped with calcium in Zhao et al. as taught by Welsch et al. because such structure would provide a better protection. As mentioned above, Welsch does not teach a dielectric layer of oxide doped with calcium, but instead a dielectric layer doped with oxides of Ca, Mg, Sr, Be, or Ba. The Examiner did not cite anything in Zhao et al. or Welsch et al. that stated that the layer taught in Welsch would provide improved protection as a barrier layer. Instead, the abstract of Welsch et al. says such a layer improves the dielectric constant, which is not desirable for a dielectric layer. The protection provided by the barrier layer is to prevent copper migration. Nothing in Zhao et al. and Welsch et al. suggests that a layer as taught in Welsch provides such copper migration protection.

For at least these reasons, claims 1, 14, and 18 are not made obvious by Zhao et al. in view of Welsch et al.

Claims 2, 3, 8, 13, 16, 17, 19, and 20 each depend either directly or indirectly from the independent claims and are therefore respectfully submitted to be patentable over the art of record for at least the reasons set forth above with respect to the independent claims. Additionally, these dependent claims require additional elements that, when taken in the context of the claimed invention, further patentably distinguish the art of record.

Applicants believe that all pending claims are allowable and respectfully request a Notice of Allowance for this application from the Examiner. Should the Examiner believe that a telephone conference would expedite the prosecution of this application, the undersigned can be reached at telephone number (831) 655-2300.

Respectfully submitted,
BEYER WEAVER & THOMAS, LLP



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